PROJECT CHARGE: 1706

PROJECT TITLE: TOBACCO PHYSICS

PERIOD COVERED: March 1 - March 31, 1977

PROJECT LEADER: D. L. Simpson

DATE OF REPORT: April 12, 1977

An Annual Report was issued and Project Review given during this period.

THERMAL PROPERTIES OF TOBACCO[1,2,3,4]
(Tiller, Majewski, Osborne, Quinn and Simpson)

In work related to the cellulosic material modification experiments of Simpson and Majewski in which the pyranose ring is opened between C2 and C3 to yield dialdehydes linked by glycosidic bands, Tiller has obtained fast-scan DTA curves for soluble starch and dialdehyde starch. The DTA spectra have been compared to that of α-cellulose. Soluble starch, which is α-1,4-linked, is thermally less stable than alpha-cellulose, which is β-1,4-linked. The dialdehyde starch is also more unstable than the alpha-cellulose and exhibits four or five endothermic processes in comparison to the two of alpha-cellulose. Since soluble starch is thermally less stable than α-cellulose and the dialdehyde starch is less stable than the soluble starch, one could infer that dialdehydic cellulose would be thermally less stable than cellulose; however, we have not yet run a fast-scan thermogram with dialdehydic cellulose. This will be done when the material is obtained.

Tiller has also continued the work on obtaining fast-scan DTA spectra for the pyrolysis solid residues from Majewski's work with cut uncased MF (J6BCM) and water extracted cut uncased MF (J6BCM). The objective here is to relate the energetics from DTA to the tobacco weight loss and chemical characteristics of the condensed volatiles from the pyrolysis studies.

Osborne and Quinn are currently determining the dynamic evolved gas analysis (DEGA) spectra for the same solid pyrolysis residues to determine the kinetics of CO and CO_2 production as a function of pyrolysis temperature. Runs have been made for CO_2 at 0.5°C/sec for residues obtained at 125°C, 165°C, and 185°C. These data will be analyzed by the next report.

COMBUSTION AND PYROLYSIS[2,5] (Majewski and Bebbs)

Bebbs has started the smoking experiments with cigarettes made from the pyrolysis solid residues of water extracted, cut,

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uncased MF (J6BCM). The residues are from the pyrolysis carried out at 145°C, 165°C, 185°C, and 200°C and were supplied by Majewski. The cigarettes are being smoked at fixed distance intervals (7 mm) with a fixed number of puffs (6 puffs) in order to remove the problem of different puff count and amount burned which results from the different residue compositions. The objective is to relate the TPM and nicotine deliveries of cigarettes made from pyrolysis residues to the pyrolysis weight loss of the original tobacco, weight of volatiles collected during pyrolysis, weight of pyrolysis condensables extracted by water, weight of pyrolysis condensables extracted by methylene chloride, and the DTA thermograms of the original tobacco and pyrolysis residues.

COMBUSTION MATHEMATICAL MODELLING[6,7] (Waymack and Simpson)

Parameters were determined to yield a solution to the new smouldering model reported last month. The results were sharper temperature and density gradients.

During the latter part of the period an approximate global kinetics scheme for CO and CO_2 production was added to the model. The results when obtained will be checked against the CO and CO_2 concentration profiles obtained by G.C. probing techniques.

REFERENCES

1) C. O. Tiller, Notebook 7003, pp. 93-100 and Notebook 7123, pp. 1-6.
2) T. Majewski, Notebook 7040, page 78.
3) S. Osborne, Notebook 7089, pp. 11-14.
4) M. Quinn, Notebook 7002, pp. 80-88.
5) J. Bebbs, Notebook 6907, pp. 82-87.
6) B. Waymack, Notebook 7082, pp. 37-46.
7) D. Simpson, Notebook 6984, pp. 97-100.

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